Vertical Plane Ambiguity

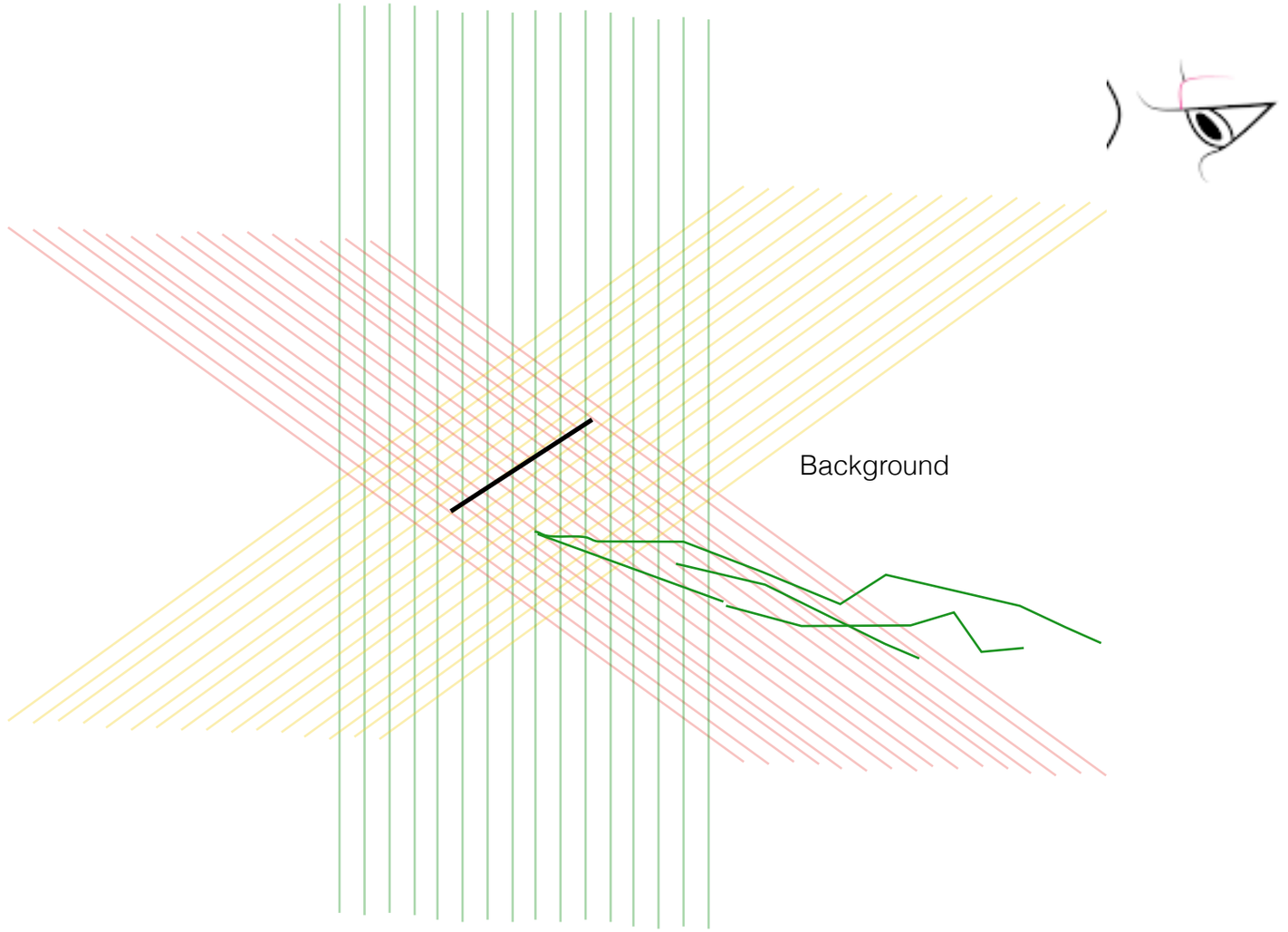
- We measure the 2-D projection of the image by further projecting it into 1-D wire readout and then combining these by using time and pattern.

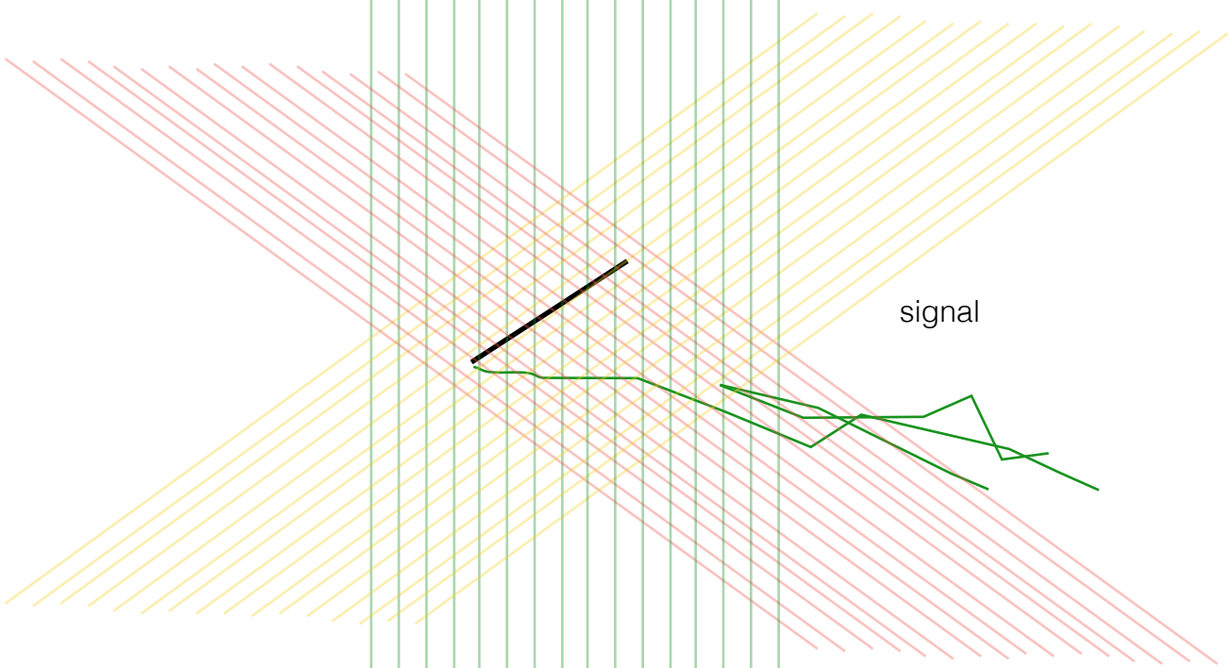
- Vertical plane ambiguity is created when the event is in the vertical plane (parallel to the wire readout) thus not allowing the use of time to associate wires.

- Due to momentum conservation if a single track is in the vertical plane then another track is also likely to be in the same plane thereby causing further reconstruction errors.

- This is a well-known problem. But we have to confront it now.

Focus only on the golden events first. These have a single shower with a recoiling nucleon(s)





Two essential cuts for background suppression
1) Gap
2) dE/dx

These do not work well if the event is in the vertical plane. The entire event need not be in the vertical plane. Only the first few cm are important.

rad length ~ 14 cm.
drift v ~ 1.6 mm/microsec.

Require that the gap for 90% of single photon conversions be visible. => gaps of >1.5 cm must be caught.

Fraction of events in the vertical plane ambiguity.

- Assume vertical is defined by 3 mm

- Fraction of two track events in the vertical plane as a function of gap length will be ~0.3cm/gap < 0.2.

- Estimate that the number of golden events is ~10-20%. About 20% of these might be affected.

- For multi-track shower events, the situation gets worse since each shower has a ~10-20% chance of being in the VPA.

Some history

- Tracking detectors have had similar issues with background suppression and analysis in the past.

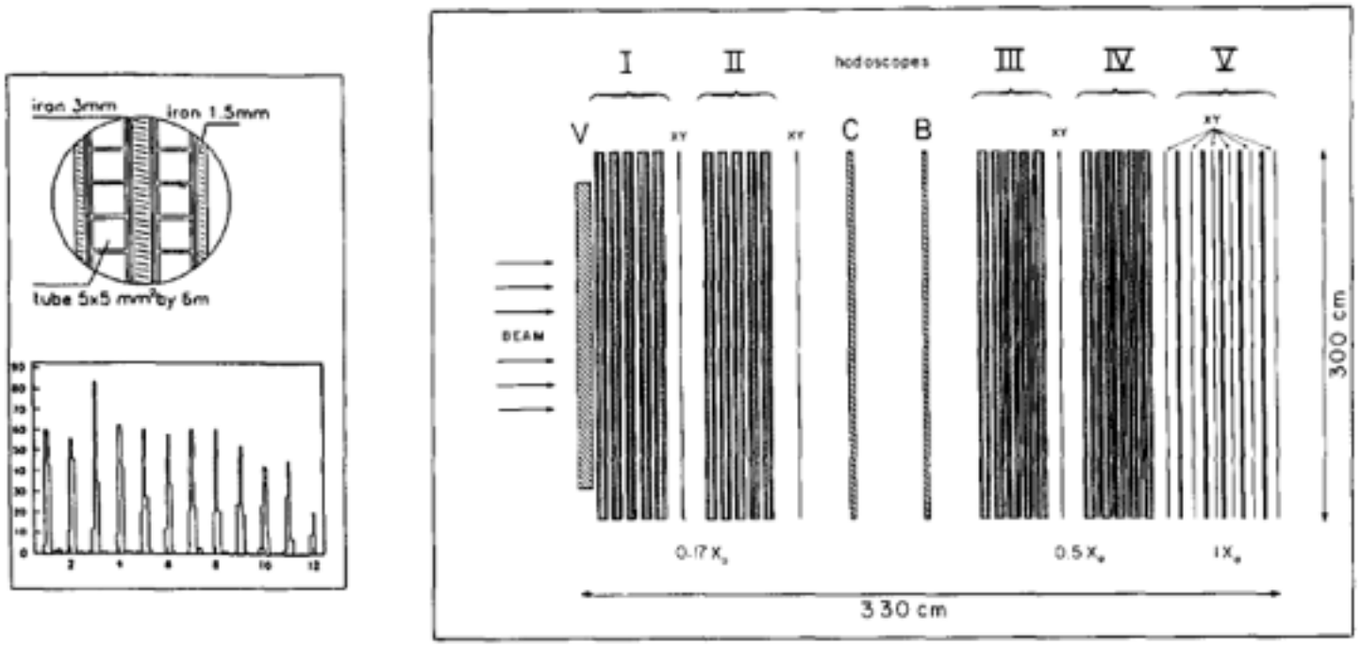
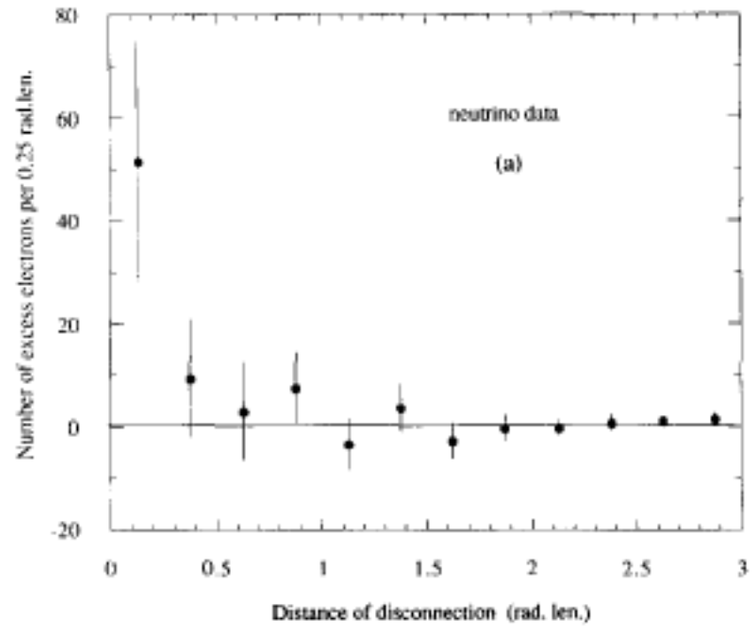


Fig. 1. The detector. The inset shows details of the flash chamber and the beam burst structure as measured by the experiment (horizontal scale gives time in units of 224 ns).



AGS-816 had only 1 view

ref: CERN-EP-89-128,

Search for Neutrino Oscillations P. Astier et al.. Jan 1989. 18 pp.
Published in Phys.Lett. B220 (1989) 646

A signal was found and later dismissed as an artifact of geometry

Solutions ?

- Need to get better estimates of the problem from generator level simulations.

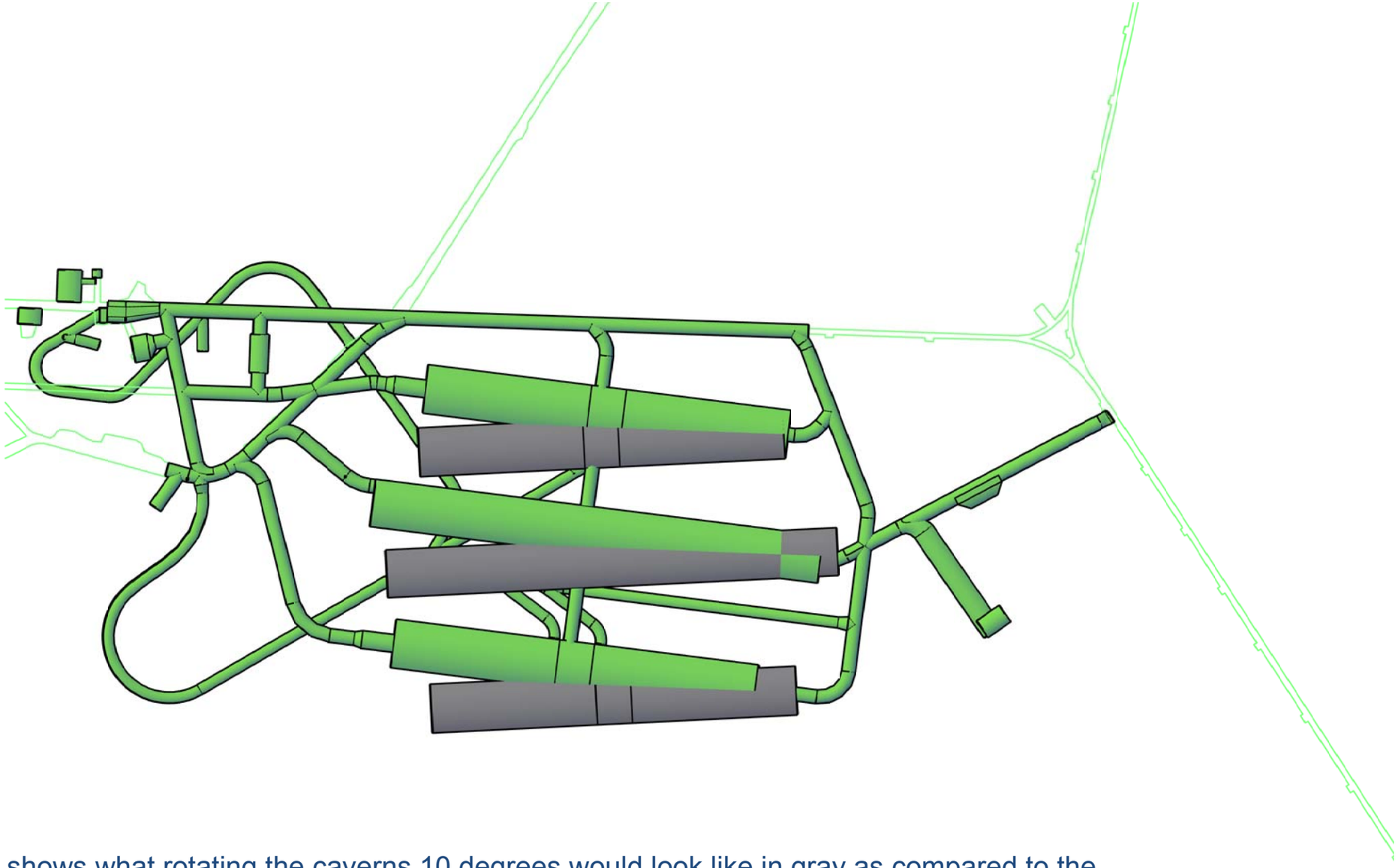
- Cannot eliminate the problem and so try to reduce it for the golden events only.

- Golden events have forward-going single leptons or showers with low multiplicity.

  - Put an angle between beam and vertical plane.

  - Either tilt the plane or rotate the cavern.

  - Adjust the collection field as a function of height ?



cartoon shows what rotating the caverns 10 degrees would look like in gray as compared to the current layout in green. Aside from the obvious need to redesign all accesses, a few comments:

The west end of the south cavern moves into a less known rock mass (outside of the area where we drilled)
2. The distance into the south cavern increases, increasing cost

3. this might be slightly favorable geotechnically based on foliation orientation.

4. The turning radius coming into both ends would be slightly easier to achieve, primarily because the west end gets further away, giving more space to turn.

appears to be technically feasible.